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Contributions to the Flora of Southeast Asia

I. Taxonomy and Phytogeography of Some Temperate Species in Thailand

by

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and Nobuyuki FUKUOKA****

General Introduction to This Series

The flora and fauna of the tropical regions are still far less known than are those of the temperate and the warm temperate regions. Thailand and Malaya are included in the regions which are not as yet sufficiently explored biologically.

A comprehensive contribution to the flora of Thailand was made by A. F. G. Kerr, who made extensive botanical trips and collections in that country, as recorded in detail by M. Jacobs in *Blumea* 11: 427-493 (1962). Kerr's collections were studied by W. C. Craib and others, as well as by Kerr himself, and were enumerated in the *Flora Siamensis Enumeratio*, 3 vols. (1925-62). The results of the Thai-Danish Botanical Expedition published in *Dansk Botanisk Arkiv* are also important contributions to the flora of Thailand. Concerning the flora of Malay Peninsula, we have no comprehensive recent work since Ridley's classical *Flora of Malay Peninsula*, 5 vols. (1922-25). To enrich the knowledge of the flora of these regions, Lecomte's *Flore Générale de l'Indo-Chine* added a good deal of valuable information. In addition the *Flora Malesiana* contains important knowledge, although only a small part has yet been published. In spite of the presence of these various contributions, our knowledge is still scanty, as these reports are incomplete and partly out of date.

Several Osaka City University Biological Expeditions have been sent to Southeast Asia, including Thailand and Malaya. Their itineraries have been recorded in *Nature and Life in Southeast Asia*, vol. 1 to 5 (1959-68). Most of the collections have been deposited in the University of Tokyo or in Kyoto University. They have been studied also by the authors of the articles included in this series of papers.

The Center for Southeast Asian Studies, Kyoto University, recently sent two biolog-

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1. Doi Tung
2. Doi Pa Hom Pok
3. Doi Chiang Dao
4. Doi Pacho(Doi Langka)
5. Doi Suthep
6. Doi Inthanon(Doi Angka)
7. Doi Khun Than
8. Huay Tak.
9. Mae Hong Song
10. Phu Luang
11. Lan Sang
12. Phu Miang
13. Phu Kradung
14. Kanchanaburi
15. Kao Yai
16. Bangkok
17. Khao Soi Dao
18. Huay Yang
19. Phangnga
20. Khao Luang
21. Tung Song
22. Khao Chong
23. Penang
24. Gua Musang
25. Cameron Highlands
26. Fraser's Hill
27. Gunong Gombok
28. Kuala Lumpur
29. Gunong Muntahak
30. Gunong Pulai
31. Singapore

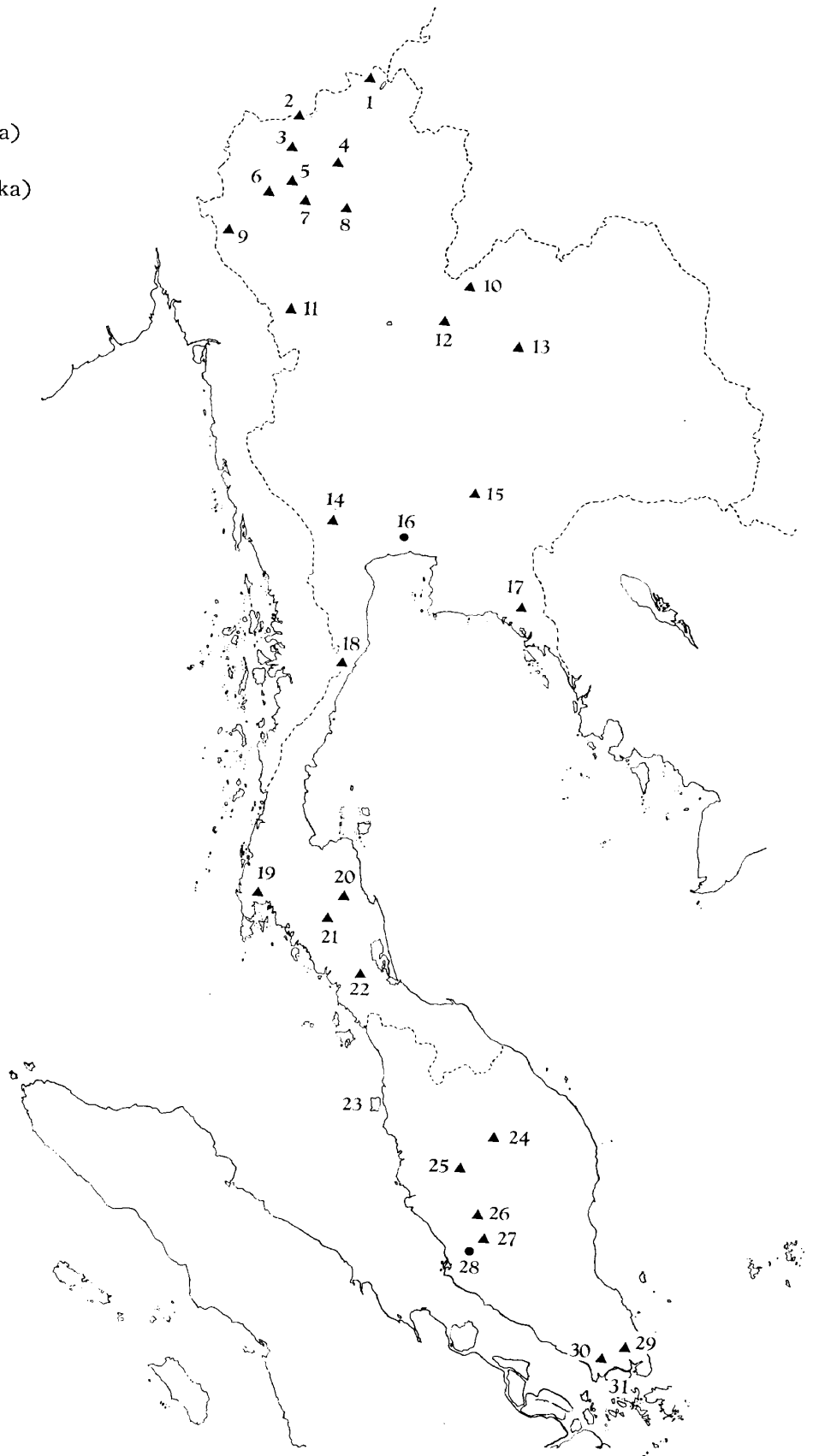


Fig. 1 The localities botanized by the Kyoto University Biological Expeditions to Thailand and Malaya, 1965-66 and 1967

ical expeditions to those regions. The first expedition, which was made by four botanists led by Dr. Motozi Tagawa, went to Thailand, and the second, made by nine botanists and an entomologist and led by Professor Joji Ashida, went to Thailand and Malaya. The members and the locations visited are:

March to April, 1965 (preliminary trip) by M. Tagawa and I. Yamada: Doi Suthep and Khao Chong.

November 1965 to February 1966 by M. Tagawa, K. Iwatsuki, N. Kitagawa, and N. Fukuoka: Doi Pacho, Doi Chiang Dao, Doi Suthep, Doi Inthanon, Tung Salaeng Luang, Phu Luang, Phu Kradung, Khao Yai, Khao Soi Dao, Khao Luang, and Khao Chong.

August to November, 1967 by J. Ashida, M. Tagawa, M. Hirano, M. Hutoh, S. Uéno, T. Shimizu, K. Iwatsuki, N. Kitagawa, H. Koyama, and N. Fukuoka: Doi Tung, Doi Pa Hom Pok, Doi Chiang Dao, Doi Suthep, Doi Khun Tan, Huay Tak, Mae Sariang, Lan Sang, Phu Miang, Phu Kradung, Khao Yai, Kanchanaburi, Huay Yang, Phangnga, Khao Luang, Thung Song, Penang, Gua Musang, Cameron Highlands, Fraser's Hill, Gunong Gombok, Templer Park, Gunong Pantl, Gunong Pulai, and Bukit Timah.

In this series of papers we intend to publish the results of our own biological trips, adding the information obtained from the materials available as far as we can. The studies are based on the materials in the following herbaria, in addition to those collected by ourselves:

AAU: Aarhus University, Aarhus, Denmark.

BK: Section of Biology, Department of Agriculture, Bangkok, Thailand.

BKF: the Forest Herbarium, Royal Forest Department, Bangkok, Thailand.

C: University of Copenhagen, Denmark.

KYO: Kyoto University, Kyoto, Japan.

SHIN: Shinshu University, Matsumoto, Japan.

SING: Botanic Gardens, Singapore.

TI: University of Tokyo, Japan.

TNS: National Science Museum, Tokyo, Japan.

We are grateful to the directors and curators of all these herbaria for giving us the opportunity to study their specimens. The plants of our own collection are numbered with the prefix T for the Thai collection and M for those from Malaya.

For making the field studies in Thailand and Malaya we have been assisted by many persons and the National Research Council of Thailand and the Royal Forest Department of Thailand. We wish to extend our sincere thanks to the directors and the staff members of these organizations. The staff members of the Forest Herbarium, Messrs. Dumrong Chaiglom, Anan Nalampoon, Aiem Chintayungkun, and others, kindly helped us in many ways in the field work in Thailand. Without their kind arrangements, we could not have succeeded in the biological investigation. In Malaya we are greatly indebted to the School of Biology, University of Malaya, and to the Forest

Research Institution. Dr. B. C. Stone was very kind to help us in various ways in Malaya. The Botanic Gardens, Singapore, arranged various things for our expedition. Thanks are also due to the staffs of all these institutions. The Ministry of Education of Japan supported financially our second trip; the expenses of M. Hutoh were paid by Kyoto Pharmaceutical College; the Center for Southeast Asian Studies, Kyoto University, provided financial as well as administrative support for our biological expedition. We are grateful to Professor Joji Asida, Professor Motozi Tagawa, and the other members of our expeditions for giving us various supports and warm friendship.

We wish to extend our thanks to Professor Shinobu Iwamura and the members of the Center for Southeast Asian Studies, Kyoto University, and also to Professor Siro Kitamura and the staff of the laboratory of Plant Taxonomy, Department of Botany, Kyoto University, for their kind assistance to our scientific expeditions and the subsequent studies on the materials obtained.

Introduction to This Article

Phytogeographically Thailand belongs to the Continental Southeast Asiatic region characterized by monsoon forest elements, characteristically represented by *Dipterocarpus*, *Shorea*, *Tectona*, etc. The northern mountain ranges higher than 1000 m elevation, however, are covered by evergreen forests consisting of *Castanopsis*, *Lithocarpus*, *Quercus*, *Cinnamomum*, *Symplocos*, etc. From such components of the forests, Ogawa & al. (1961) concluded the forest type there to be a warm temperate vegetation, which Smitinand (1966) and Robbins and Smitinand (1966) called the hill evergreen forests. In this zone are found, as Craib (1926) pointed out, some temperate species which are the same as or closely related to those of the East Asiatic temperate region, especially those of the Himalayas.

In this part of the series, we intend to enumerate some temperate species found in Thailand and to analyze their phytogeographical aspects, for we consider that it is an important contribution to the phytogeography of Thailand. Indeed, it is our particular concern to understand where and how the temperate species are distributed in Thailand, which lacks mountains higher than 2595 m, the height of Doi Inthanon.

Enumeration of the Species

Ainsliaea latifolia (D. Don) Sch.-Bip. in Pollichia 18-19: 169. 1861; Kitam. in Acta Phytotax. Geobot. 19: 14. 1961, 23: 6. 1968, in Hara, Fl. East. Himal. 330. 1966. — *Liatris latifolia* D. Don, Prodr. Fl. Nepal. 169. 1825, with descr.

A. pteropoda DC., Prodr. 7: 14. 1838; Gagnep. in Lecomte, Fl. Gén. Indo-Chine 3: 663. 1924; Kerr in Craib, Fl. Siam. Enum. 2: 295. 1936.

A. reflexa Merr. in Philip. Jour. Sc. 1 (Suppl. 3): 242. 1906; Kitam., Comp. Jap. 2: 306. 1940.

Chiang Mai: Doi Inthanon, T*2866(KYO), T. Smitinand & I. Alsterlund 6695 (BKF), Winit 1344 (BK, BKF); Doi Chiang Dao, Put 418 & 4461 (BK); Doi Pa Hom Pok, Kerr 5187 (BK). Loei: Phu Luang, T1611(KYO).
—On humus covered slope in mossy evergreen forests, at 1300-2595 m alt.

Distr. Himalaya, Central China, Northern Indo-China, Philippines and Taiwan.

The leaves of the Thai specimens cited above are pilose with long slender hairs on both sides, but not white-tomentose on the netted veins beneath. Some specimens, however, have both kinds of hair on the leaves; slender long hairs and white wooly ones as shown in Fig. 2. In this respect, the Thai plants correspond with Form 1 in Kitamura (1966).

This species is widely distributed horizontally and altitudinally. In Taiwan we saw it growing both in the cool temperate zone and in the subalpine coniferous zone.

(H. Koyama)

Anaphalis margaritacea (L.) Benth. & Hook. f., Gen. Pl. 2: 303. 1873; Gagnep. in Lecomte, Fl. Gén. Indo-Chine 3: 553. 1924; Kerr in Craib, Fl. Siam. Enum. 2: 269. 1936; Kitam., Comp. Jap. 1: 242. 1937, in Kihara, Faun. Fl. Nepal Himal. 1: 245. 1955, in Acta Phytotax. Geobot. 19: 12. 1961, 23: 9. 1968, in Hara, Fl. East. Himal. 331. 1966. —*Gnaphalium margaritacea* L., Sp. Pl. 2: 850. 1753.
Chiang Mai: Doi Suthep, T3238 (KYO), Kerr s.n. (BK); Doi Chiang Dao, T4158 & T 4361(KYO), Kerr 6571 (BK), T. Smitinand 3966 (BKF); Doi Inthanon, T2585 (KYO), Winit 1346 (BK, BKF), Lakshnakara 1496 (BK); Doi Khun Huai Pong, B. Hansen & T. Smitinand 12769 (BKF).—Usually in grassy fields, but also in limestone crevices on Doi Chiang Dao, at 1000-2000 m alt.

Distr. East Asia and North America.

The present species is widely distributed in Eastern Asia, including Himalaya, and also in North America. Four subspecies are recognized by Kitamura (1937); subsp. *japonica* and *yedoensis* in Japan, and subsp. *morrisonicola* in the high mountains of the Philippines and Taiwan. In Thailand and the adjacent countries, the plants are all represented by subsp. *margaritacea*. The area of this subspecies covers almost whole of that of the species, but it is sometimes replaced by the other subspecies noted above.

*All the specimens of our collection will be cited in T-number. The collectors are various according to the localities and the dates botanized.

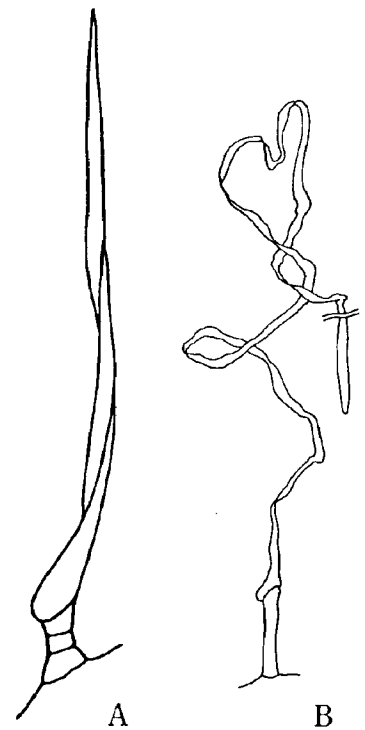


Fig. 2 Structure of leaf hairs in *Ainsliaea latifolia*
A : slender hair ($\times 200$)
B : white tomentose ($\times 200$)

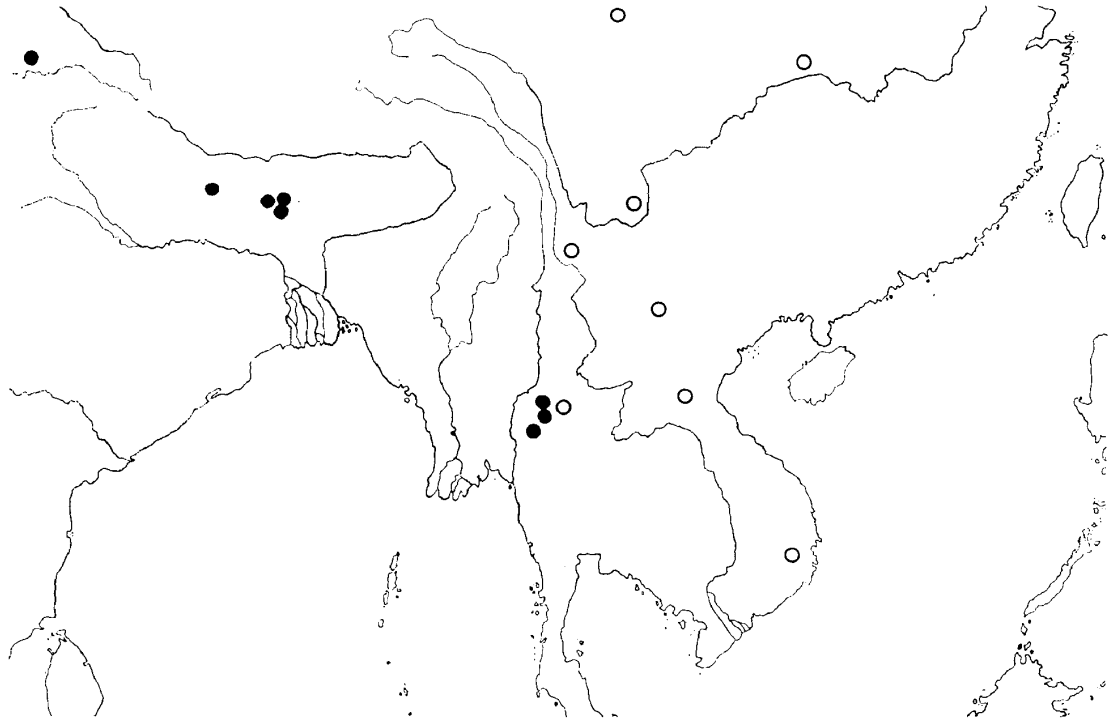


Fig. 3 Range of *Anaphalis margaritacea* subsp. *margaritacea*
disks: specimens examined; circles: literatures

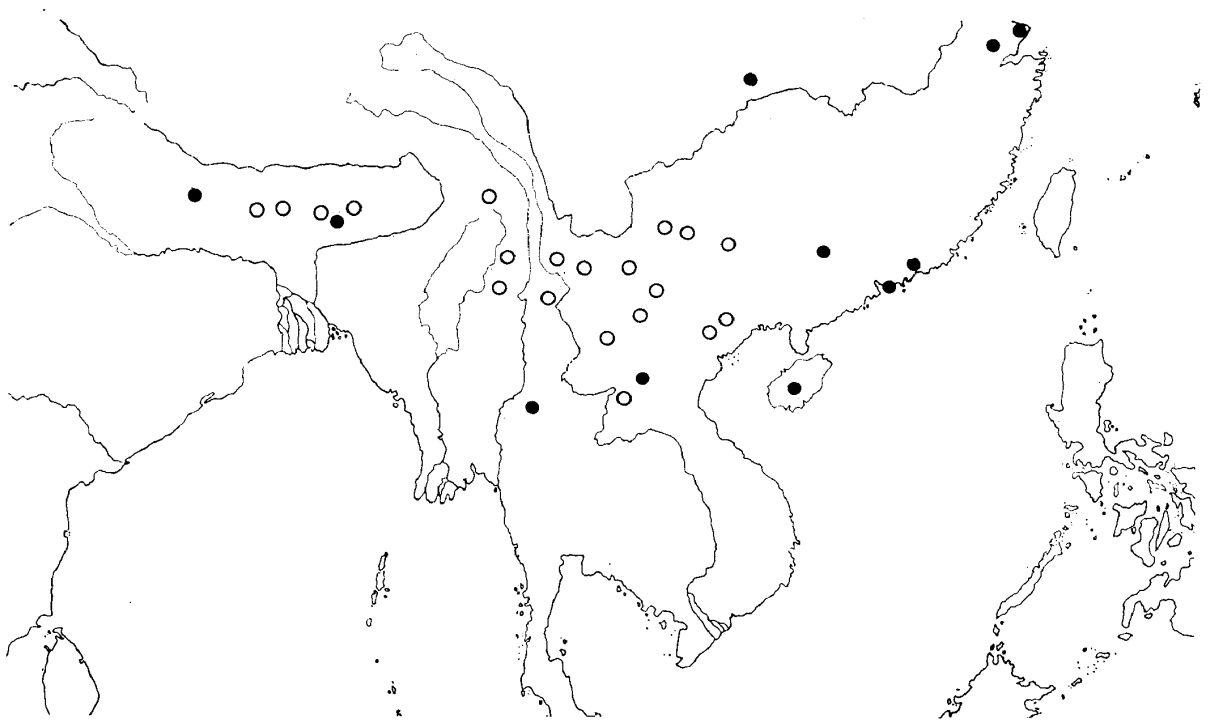


Fig. 4 Range of *Aster ageratoides* subsp. *alato-petiolata*
disks: specimens examined; circles: literatures

Judging from the facts that a number of species of *Anaphalis* occur in Southwest China and Himalaya, and that most of them are distributed mainly in the cool temperate zone, the present species may have spread southwards along the high mountains of the Indo-China Peninsula to Thailand and Vietnam. (H. Koyama)

Aster ageratoides Turcz. subsp. **alato-petiolata** Kitam. in Kihara, Faun. Fl. Nepal Himal. 1: 247. 1955, in Acta Phytotax. Geobot. 23: 12. 1968.

A. benthamii Steetz in Seem. Bot. Voy. Herald. 385. 1857; Kerr in Craib, Fl. Siam. Enum. 2: 252. 1936.

Diplopappus laxus Benth. in Hook., London Jour. Bot. 1: 487. 1842.

Chiang Mai: Doi Chiang Dao, Kerr 6591 (BK), T4146 (KYO), T. Smitinand & J. A. R. Anderson 7299 (BKF). —Sunny grassy slope, at 1900–2050 m alt.

Distr. Himalaya (from central Nepal to eastwards), Northern Indo-China and Central China.

Aster ageratoides occurs widely in Eastern Asia, and has been variously delimited by investigators. Although Grieson (1964) treated *A. ageratoides* as a subspecies of *A. trinervius* in his revision of the *Asters* (in Notes Roy. Bot. Gard. Edinb. 26: 102), Kitamura (1968) considered *A. ageratoides* as an independent species. Considering the wide variation in taxonomic characters in *A. ageratoides*, we consider these two species best treated as distinct species.

In Thailand, the present plant is known only from the summit area of Doi Chiang Dao. (H. Koyama)

Boenninghausenia albiflora (Hook.) Roxb. ex Meissn., Pl. Vasc. Gen. 2: 44. 1836; Hook. f., Fl. Brit. Ind. 1: 486. 1875; Craib, Fl. Siam. Enum. 1: 215. 1931; Kanai in Hara, Fl. East. Himal. 169. 1966. —*Ruta albiflora* Hook., Exot. Fl. t. 79. 1823.

B. schizocarpa S. Y. Hu in Jour. Arn. Arb. 32: 391. 1951.

Chiang Mai: Doi Chiang Dao, T4379, T9874 & T10025 (KYO); Chiang Dao, Pang Boh to Khun Khong, T. Smitinand & al. 8722 (BKF); Doi Inthanon, T2633 (KYO); Mae Lan Noi, TDBS 10947 (BKF). —Grassy field on mountain slopes or in limestone crevices in open place, at 1200–2150 m alt.

Distr. Nepal to Japan, Indo-China, Taiwan and Luzon.

The leaves and stems of our specimens from Himalaya, Thailand and Taiwan vary from densely pubescent to nearly glabrous, while those from Japan are all glabrous. Hu (1951) described *B. schizocarpa* from Yunnan as having the stipes shortly branching at the top. In *B. albiflora* of Himalaya and Thailand, however, this character varies from distinctly to scarcely branching. Therefore, this seems not to be a specific character.

B. sesseilicarpa from Yunnan and Szechuan differs from the present species merely by the non-stipitate carpels.

Geographically this species is to be regarded as a Himalayan element. (N. Fukuoka)

Clarkella nana (Edgw.) Hook. f., Fl. Brit. Ind. 3:46. 1880; K. Schum. in Engl. & Prantl, Nat. Pfl.-fam. 4, 4:31. 1891. — *Ophiorhiza nana* Edgw. in Trans. Linn. Soc. 20:60. 1846.

Radical leaves solitary, large. Cauline leaves one- or rarely two-paired. Cymes 2 to 5-flowered, pubescent. Calyx pubescent outside, sparsely so inside; tube 1 mm long; lobes 5 (4), deltoid, acute at apex, 1.5–2.5 mm long, 2 mm wide. Corolla hypocrateriform, pubescent outside, glabrous inside; tube 8–15 mm long, 1–1.5 mm across; lobes 5, oblong, acute at apex, 4–6 mm long, 2 mm wide. Stamens 5, adnate near the base of corolla-tube; filaments 1 mm long; anthers linear-oblong, 1.5 mm long, 0.3 mm wide. Ovary pubescent, obconical, about 2 mm long and wide; style 0.5 mm long; stigma 1.3 mm long, bilobes, erect.

Chiang Mai: Doi Chiang Dao, T9949 (KYO).—On mossy limestone in shady place, at 1100–1800 m alt.

New to Thailand.

Distr. West Himalaya.

var. **siamensis** (Craib) Fukuoka & Kurosaki, stat. nov. — *C. siamensis* Craib in Kew Bull. 1931:216.

Nakhon Si Thammarat: Khao Chaem, Thung Song, Rabil 139—type (BK).

Known only from the type collection.

Only two species of *Clarkella* have been recognized: *C. nana* Hook. from West Himalaya and *C. siamensis* Craib from Peninsular Thailand. Craib (1931) notes that the latter is much larger in all respects than the former. Our specimen, T9949, well accords with Hooker's description of *C. nana*. Comparing the photograph of the isotype as well as the original description of *C. siamensis* with our specimens and Hooker's description of *C. nana*, we can not find any differences warranting the specific discrepancy between them, except size. Therefore, Craib's species may better be reduced to a variety of *C. nana*. (N. Fukuoka & N. Kurosaki)

Clematis siamensis Drummond & Craib in Kew Bull. 1915:420; Craib, Fl. Siam. Enum. 1:15. 1925.

Chiang Mai: Doi Inthanon, interior of Ban Yang, T3050 (KYO).—Bushes on the glade in the evergreen forest, at 1300–2000 m alt.

Distr. Endemic in North Thailand.

As pointed out by Drummond & Craib (1915), this species is closely related to *C. sikkimensis* (Hook. f. & Thoms.) Drummond ex Burkill, which occurs in the temperate zone of East Himalaya through Assam and Upper Burma to Yunnan. Our specimen, T3050, is within the limit of variation of *C. sikkimensis* in having large chartaceous leaflets up to 13 cm long and 7 cm wide. However, more plentiful specimens must be examined to determine whether these two species are really distinct or not.

Hitherto the present species is known only on Doi Suthep (type locality) and Doi

Inthanon.

(T. Shimizu)

Clematis wattii Drummond & Craib in Kew Bull. 1915 : 421 ; Craib, Fl. Siam. Enum. 1 : 16. 1925 ; Smitinand in Nat. Hist. Bull. Siam. Soc. 21 : 101. 1966.

Chiang Mai : Doi Chiang Dao, T4372 (KYO), Put 4459 (BK) ; Doi Pha Khao, Garrett 115 —isotype (BK, BKF). — Among limestone rocks in open places at least in Doi Chiang Dao, at 1400–2000 m alt.

Distr. Endemic in North Thailand.

This species, originally reported from Doi Pha Khao, 1400 m, and Doi Chiang Dao, 1770 m, is conspicuous by its dense golden brown tomentum. Thus it recalls *C. grewiaeflora* DC. from Himalaya, Assam and Upper Burma. In its narrower, not globose buds and its sepals covered with grayish hairs, however, the present species is nearer to *C. buchananiana* DC. than to *C. grewiaeflora*. The former is more widely distributed, being found from Himalaya to Indo-China and West China. According to Hooker & Thomson (1872), it occurs throughout the temperate Himalaya, at 5000–10000 ft. in altitude.

(T. Shimizu)

Cornus oblonga Wall. var. **siamica** Geddes in Craib, Fl. Siam. Enum. 1 : 808. 1931.

Chiang Mai : Doi Chiang Dao, T10136 (KYO), Kerr 6605 (BK), Put 425 & 4451 (BK), T. Smitinand & J. A. R. Anderson 7270 (BKF), T. Smitinand & Abbe 6252 (BKF), T. Smitinand 4746 (BKF). — Rocky sunny place of limestone on mountain slope, at 1900–2100 m alt.

Distr. Endemic in North Thailand.

This variety differs from the typical form, which occurs in Himalaya (Kashmir to Bhutan), Assam, Upper Burma and China (Szechuan, Yunnan and Kweichow), in having broader and shorter leaves. But this difference is sometimes indistinct. On the other hand, f. *pilosula* Li was reported from Yunnan, characterized by the dense covering of hairs on the under leaf surfaces. However, it should be reduced to a synonym of var. *oblonga*, because we can not distinguish both forms from each other by villosity of the leaves. Another variety from Bhutan, var. *griffithii* Clarke, is characteristic of the leaves being covered with spreading hairs beneath.

(N. Fukuoka)

Cotoneaster franchetii D. Bois in Rev. Hort. Paris 1902 : 380, in Vilmorin & Bois, Frut. Vilmorin. 117. 1904 ; Fedde in Fedde Rep. 3 : 228. 1906 ; Rehd. & Wils. in Sarg., Pl. Wils. 1 : 165. 1912 ; Craib, Fl. Siam. Enum. 1 : 577. 1931 ; Hand.-Mazz., Symb. Sin. 7 : 458. 1933 ; Smitinand in Nat. Hist. Bull. Siam. Soc. 21 : 104. 1966.

Chiang Mai : Doi Chiang Dao, T4376 (KYO, SHIN), Kerr 6611 (BK). — Among limestone rocks in sunny place, at 2150 m alt.

Distr. Yunnan and West Szechuan.

In Thailand, this shrub is known only from the limestone ridge in Doi Chiang Dao. It occurs mainly between 2000 m and 3000 m alt. in West Szechuan and Yunnan. Schneider (1906) reports this plant also from Tibet.

(T. Shimizu)

Delphinium altissimum Wall. var. **siamense** (Craib) T. Shimizu, comb. nov. — *D. stapeliosum* Brühl var. *siamense* Craib, Fl. Siam. Enum. 1: 19. 1925; Smitinand in Nat. Hist. Bull. Siam. Soc. 21: 101. 1966. *D. siamense* (Craib) Munz in Jour. Arn. Arb. 49: 116. 1968. Chiang Mai: Doi Chiang Dao, T9878 (KYO), Put 337 & 4454 (BK), Kerr 6612—isotype (BK), T. Smitinand & al. 7778 (BKF), T. Smitinand 4710 (BKF). —Open rocky slopes of limestone, at 1100–2100 m alt.

Distr. Endemic in North Thailand.

The present plant is also found only on Doi Chiang Dao in Thailand. I found it scattered on rocky ridges and on steep slope of limestone.

Munz (1968) raised up this Doi Chiang Dao plant to an independent species. Since it is different from *D. altissimum* merely in having paler colored perianths, it would better be treated as a variety. The area of the mother species is in Nepal, Sikkim, and Bhutan. (T. Shimizu)

Geranium lamberti Sweet subsp. **siamense** (Craib) T. Shimizu, stat. & comb. nov. — *G. siamense* Craib in Kew Bull. 1926: 158, Fl. Siam. Enum. 1: 208. 1931; Smitinand in Nat. Hist. Bull. Siam. Soc. 21: 102. 1966.

Chiang Mai: Doi Chiang Dao, T4378 & T10143 (KYO), T. Smitinand 4725 (BKF). —Among limestone rocks, at 1900–2175 m alt.

Distr. Endemic in North Thailand.

This plant is characterized by its pink petals 1.5 cm long and about twice as long as the sepals, and by the deeply 5-parted stigmas about 5 mm long. In these respects, in spite of Craib's opinion, it is nearer to *G. lamberti* than to *G. nepalense* Sweet. From *G. lamberti*, however, it is different in the absence of glandular hairs on the pedicels and on outside of the sepals and in having pale pink (not dark pink) filaments.

The limestone ridge in Doi Chiang Dao is the sole home of the present plant. According to Edgeworth & Hooker (1874), this species occurs in temperate Himalaya from Kumaon to Sikkim between 2400 m and 3500 m alt. (T. Shimizu)

Geranium nepalense Sweet, Geraniac. 1: t. 12. 1820, in Hook. f. & Thoms., Fl. Brit. Ind. 1: 430. 1874; Knuth in Engl., Pfl.-reich IV-129, 53: 192. 1912; Hara, Fl. East. Himal. 167. 1966.

Phitsanulok: Phu Rom Rot, one of the peaks of Phu Miang, T11524 (KYO). —Open from abandoned farm, at 1200–1600 m alt.

New to Thailand.

Distr. Afghanistan, Himalaya, Khasia, Manipur, Tonkin, Yunnan and Szechuan.

We found this plant crowded like a weed on open arable land. It is uncertain whether its presence is due to human influences. (T. Shimizu)

Luculia gratissima (Wall.) Sweet var. **glabra** Fukuoka, var. nov. — *L. gratissima* (non Sweet) Craib, Fl. Siam. Enum. 2: 22. 1932.

Ovarium inflorescentiaque glabrum.

Chiang Mai: Doi Chiang Dao, Kerr 6545 (BK), T10017—type (KYO; isotype in A, AAU, BKF, E, K, L, SHIN, TI, TNS), T4144 (KYO, A, BKF, E, K, SHIN, SING, TI). Hennipman 3291 (BKF), T. Smitinand & al. 7856 (BKF), T. Smitinand & Abbe 6233 (BKF).—Crevices in limestone on sunny ridge, at 1700–2100 m alt.
Distr. Endemic in North Thailand.

The genus *Luculia* occurs from Nepal to Yunnan and southward almost to Thailand. Five species have been described: *L. gratissima*, *L. pinceana* Hook., *L. intermedia* Hutchins., *L. yunnanensis* Hu and *L. grandiflora* Ghose. The Thai plants are *L. gratissima*, which is distinguishable from the others by the corolla-lobes without interposed tubercles. However, I have found that the material from Thailand differ from the Himalayan plants in hairiness on the ovary and the cyme. The ovary of the former is glabrous and the cyme is almost so. In the latter, the ovary and the cyme densely or sparsely covered with brownish hairs. The specimen T4144 is from a dwarf plant; 1 m tall, the cyme up to 2 cm long and wide, the leaves lanceolate-oblong, 3–7 cm long, 1–2.5 cm wide.

Geographically the species is an inhabitant of Nepal to Bhutan, Assam and Upper Burma, while the present variety is a limestone loving plant known only from Doi Chiang Dao. (N. Fukuoka)

Parnassia siamensis T. Shimizu in Acta Phytotax. Geobot. 24: 41. 1969.

A small herb, 4–8 cm tall. Radical leaves cordate, 5–8 mm long, 6–8 mm wide, with petioles 5–15 mm long. Cauline leaves solitary, smaller than the radical ones, 2–4 mm long, sessile. Flowers white, 1 cm or so across; sepals obovate, 3–4 mm long; petals ovate-elliptic, erose-denticulate on the margin but entire around apex, 5–8 mm long, 4–5 mm wide; staminodes candelabriform, 2.5 mm long, 3 to 5-lacerate.

Chiang Mai: Doi Chiang Dao, T10028—type (KYO).—Mossy limestone in light thicket at ridge, at 1900–2175 m alt.

Distr. Endemic in North Thailand.

Kerr (1934) reported *P. mysorensis* Heyne ex Wight & Arnott, based on Garrett 702 found in 'crevices of rock-faces at an altitude of about 1600–1650 m in Doi Pa Kao, Chiang Mai'. This specimen, according to his drawing, is a plant 13 cm tall with obovate petals and 3-lobed staminodes. Also, the specimens of *P. mysorensis* available to us, viz. Houa la po, 3000 m alt., Delavay s. n. (TNS) and Tolo Gompa Khola, 3900 m, S. Nakao 195 (KYO), are provided with obovate petals and deeply trilobed staminodes. On the other hand, our plants are peculiar in having ovate-elliptic petals and especially 3 to 5-lacerate candelabriform staminodes.

In addition, one of us found the third plant of *Parnassia* on a fen near Om Koi, 900 m alt., in North Thailand by the Thai-Danish Expedition in 1964. The specimen, B. Hansen, G. Seidenfaden & T. Smitinand 10842 (C), is its representative. This is a large plant, 20–30 cm tall, characterized by the large cordate leaves, 2–4 cm long and 3–

5 cm wide, and the deeply 5-lobed staminodes, 3.2 mm tall. Consequently it is apparently different from both *P. mysorensis* and *P. siamensis*. Since the petals are lost in the specimen, however, its classification remains still questionable.

(T. Smitinand & T. Shimizu)

Saxifraga gemmipara Franch. var. ***siamensis*** T. Shimizu, var. nov. — *S. gemmipara* (non Franch.) Craib, Fl. Siam. Enum. 1: 581. 1931; Smitinand, Nat. Hist. Bull. Siam. Soc. 21: 104. 1966.

Floribus majoribus var. *gemmiparis*.

Chiang Mai: Doi Chiang Dao, T10027 — type (KYO; isotype in SHIN), Kerr 6606 (BK), T. Smitinand & al. 7760 (BKF), T. Smitinand & J. A. R. Anderson 7238 (BKF). — Open limestone ridge, at 2000–2100 m alt.

Distr. Endemic in North Thailand. Var. *gemmipara*: Yunnan & Szechuan.

In comparison with the Yunnan plants, A. Henry 10380 (TNS) and P. Y. Chiu 596116 (SHIN), our specimens have larger flowers with petals 6–6.5 mm long, 2.5–3 mm wide; the sepals 3.5 mm long, 2 mm wide; the filaments 5.5–6 mm long and the capsules 6.5 mm long. In the Yunnan plants, the petals are 4–4.5 mm long, 1.2 mm wide; the sepals 2–2.2 mm long, 1 mm wide; the filaments 4–4.5 mm long, and the capsule 4.5–5 mm long. Therefore, the Thai plants could be separated as a variety (See Fig. 5).

The occurrence of this new plants is also due to limestone ridges of Doi Chiang Dao.

(T. Shimizu)

Scabiosa siamensis Craib in Kew Bull. 1933: 30, Fl. Siam. Enum. 2: 234. 1934.

Chiang Mai: Doi Chiang Dao, Put 411 — type & 4462 (BK), Kerr 6594 (BK), T4162, T4362 & T10022 (KYO). — Crevices in limestone rocks in open place, at 2000–2175 m alt.

Distr. Endemic in North Thailand.

According to Craib, this is related to *S. hookeri* C. B. Clarke occurring in Himalaya (Nepal to Bhutan), Yunnan and Szechuan. In our plants the peduncles are covered with short curved hairs, the linear to linear-spathulate bracts end in an obtuse apex, and the sparsely pubescent leaves are not lobed on the margin and have much prominent midribs and lateral veins beneath.

The occurrence of this species is due to limestone ridges. (N. Fukuoka)

Senecio raibianus Hoss. in Bot. Centralb. Beih. 28: 454. 1911; Gagnep. in Lecomte, Fl. Gén. Indo-Chine 3: 640. 1924; Kerr in Craib, Fl. Siam. Enum. 2: 291. 1936; Koyama in

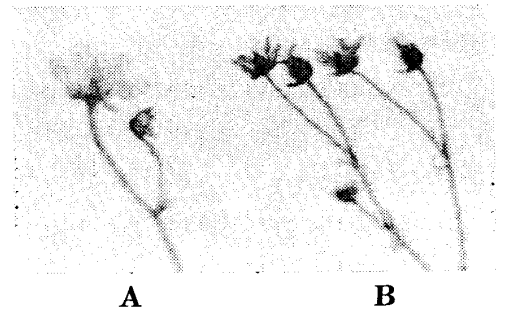


Fig. 5 Comparison of the floral size between *S. gemmipara* var. *siamensis* and var. *gemmipara*
A: var. *siamensis*, T10027
B: var. *gemmipara*, A. Henry 10380
× ca. 1

Mem. Fac. Sci. Kyoto Univ. Ser. Biol. 3: 153. 1969.

Chiang Rai: Doi Pacho, T3639 (KYO). Chiang Mai: Doi Chiang Dao, T4143 (KYO), T. Smitinand 4239 (BKF), Put 4481 (BK), Garrett (BKF); Chiang Dao, Doi Nang, Chant-hmuk 650 (BK).—Rocky ridges of limestone in dry upper mixed deciduous forest, at 1580–2100 m alt.

Distr. Endemic in North Thailand.

This species is referred to Sect. *Jacobaea*, which includes about 40 species and occurs in the cool temperate zone of Eurasia. Among its members, *S. griffithii* Hook. f. & Thoms. ex C. B. Clarke, occurring in East Himalaya, is nearest to the present species. (H. Koyama)

Senecio nagensium C. B. Clarke var. ***lobbii*** (Hook. f.) Craib in Kew Bull. 1911: 402; Kerr in Craib, Fl. Siam. Enum. 2: 291. 1936; Koyama in Mem. Fac. Sci. Kyoto Univ. Ser. Biol. 3: 149. 1969.—*S. densiflorus* Wall. ex DC. var. *lobbii* Hook. f., Fl. Brit. Ind. 3: 355. 1881.

Chiang Rai: Doi Pacho, T3653 (KYO). Chiang Mai: Doi Inthanon, T2589 (KYO); Doi

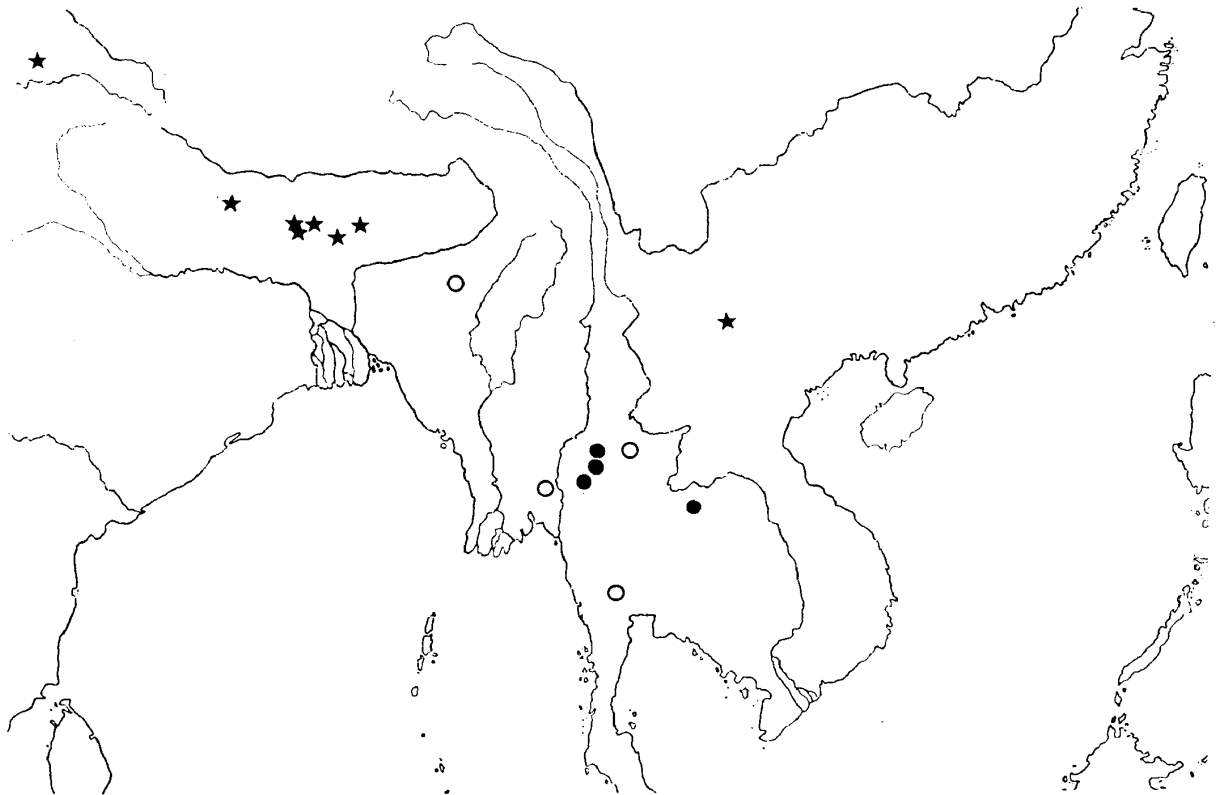


Fig. 6 Ranges of *Senecio nagensium* and *S. densiflorus*
disks: specimens and circles literatures of *S. nagensium*
asters: *S. densiflorus*

Suthep, T4485 (KYO), T. Smitinand 3370 & 3776 (BKF), Chermisiriwathana 552 (BK), Sukri 82 (BKF); Doi Pha Khao, Mae Ya, Garrett 108 (BKF); Doi Chiang Dao, T4141 (KYO), Put 4482 (BK), T. Smitinand 4238 (BKF). Loei: Phu Kradung, T881 (KYO), T. Smitinand 2144 & 4970 (BKF), Bunpheng 263 & 269 (BKF). —Grassy field in light forest, at 1100–1900 m alt. Distr. South Yunnan and East Burma.

The present variety has white wooly hairs on the lower leaf surfaces and also reddish hirsute hairs on the veins (Fig. 7). The hirsute hairs of var. *lobbii* are very variable in color ranging from pale-brown to dark-reddish brown. Although the leaves of var. *nagensium* are said to have no reddish hairs on the veins beneath, it is questionable if they lack any kind of hirsute hairs at all. These hairs are also found in *S. densiflorus* Wall. ex DC., which is close to *S. nagensium*. Both of the species belong to Sect. Synotis Series Erectae (C. B. Clarke) H. Koyama. Most species of this series are distributed in temperate Himalaya and South China. (H. Koyama)

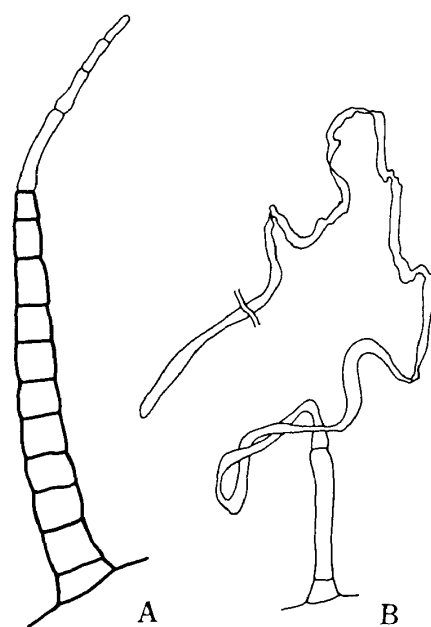


Fig. 7 Structure of leaf hairs in *Senecio nagensium* var. *lobbii*
A : hirsute hair ($\times 80$)
B : white wooly hair ($\times 200$)

Thalictrum calcicolum T. Shimizu in Acta Phytotax. Geobot. 24: 41. 1969.
var. **calcicolum**

Wholly glabrous. Stems erect, 0.5–1 m tall, sulcate, stramineous but sometimes tinged with purple. Leaves 2 or 3-ternate, without secondary stipules, petiolate; petioles sulcate, vaginate at base, the sheath auriculate. Leaflets chartaceous or coriaceous, suborbicular or obovate, trilobed on the upper half into entire or crenate lobes, cordate to rounded at base, 1–2.5 cm long and wide, rarely 3.2 cm long and 3.4 cm wide; the nerves distinct, somewhat elevated above, prominently reticulate-elevated beneath. Inflorescence paniculate-corymbiform, axillary and terminal. Flowers white, small; sepals 4, obovate, about 4 mm long, caducous; stamens 5 mm long; the filaments clavate, thicker than the anthers; the anthers 0.8 mm long, with connectives never mucronate at apex. Achenes 3–9, 3–4 mm long, sessile; the costa 8–10, elevated; stigma persistent, hooked.

Chiang Mai: Doi Chiang Dao, T10034—type (KYO; isotype in BKF, SHIN), T10242 (KYO), UNESCO 1061 (BKF, L), T. Smitinand & al. 7793 (BKF); Doi Pha Khao, west slope, Garrett 690 (BKF).—Among limestone rocks in open ridges, at 1650–2175 m alt.

var. **longicarpum** T. Shimizu, var. nov.

Acheniis typo majoribus, 6–7 mm longis, stylis elongatis.

Chiang Mai: Doi Chiang Dao, T10034 bis—
type(KYO).—Among limestone rocks in open
ridges, at 1900–2175 m alt.

Distr. Endemic in North Thailand.

The present plant resembles *T. reticulatum*
Franch. from Yunnan in being completely glab-
rous and in the texture and venation of the
leaflets. Although I have no specimens of the
latter at my hand, they are easily distinguish-
able each other, because Franchet (1886)
described his species as having leaf-sheath not
auricled, the achenes 15–18 in number, not
exceeding 2 mm long, and, according to his
drawing (1889), the stigmas short and never hooked. Our plants have larger achenes
3–4 mm long with hooked persistent stigmas, and distinctly auricled leaf-sheaths.

Some of our plants have larger achenes 6–7 mm long, with conspicuous elongate
beaks, from which characters the name var. *longicarpum* is derived. The achenes of
var. *calcicolum* and var. *longicarpum* are illustrated in Fig. 4. They occur on the same
limestone ridges in Doi Chiang Dao. (T. Shimizu)

Thalictrum foliolosum DC., Syst. 1: 175. 1818; Hook. f. & Thoms., Fl. Brit. Ind. 1: 14.
1872; Lecoyer, Monogr. Thalict. 115. 1885; Craib, Fl. Siam. Enum. 1: 18. 1925; Smitinand
in Nat. Hist. Bull. Siam. Soc. 21: 101. 1966, as *foliosum*; Hara, Fl. East. Himal. 91. 1966.
Chiang Mai: Doi Chiang Dao, T9838, T9909 & T9910 (KYO), UNESCO 1015 & 1043
(BKF); Muong Khu, south peak, H. Ogawa & al. 217–1, –10 & –21 (TI).—Grassy slope,
sunny or in the light forest, at 500–1800 m alt.

Distr. Himalaya, Khasia, Manipur, and Upper Burma.

This Himalayan plant extends to North Thailand, where it grows in open or
somewhat shady grassy sites higher than 500 m in altitude. Craib (1925) reported it
also from Mae Tuen, 1000–1200 m. (T. Shimizu)

Thalictrum siamense T. Shimizu in Acta Phytotax. Geobot. 24: 42. 1969.

Stems erect, sulcate, glabrous, stramineous but sometimes tinged with purple,
25–50 cm tall. Leaves ternate below, simple above; petioles up to 10 cm long, stipulate.
Leaflets chartaceous, nearly orbicular, shallowly 3 to 5-lobed, with the lobes again
trilobed and crenate, deeply cordate to truncate at base, 2–6 cm in both ways, sparsely
hirsute with multi-cellular crisped patent hairs on both sides; nerves reticulate, elevated
on both sides; petiolules up to 4 cm long, the central one longest, without secondary
stipules. Inflorescence paniculate-corymbiform, axillary and terminal. Flowers white,
small; sepals 4, elliptic, 5.5 mm long, 4 mm wide, caducous; stamens 5–6 mm long; the
filaments clavate, nearly equal to anthers in width; the anthers 1.5 mm long, with

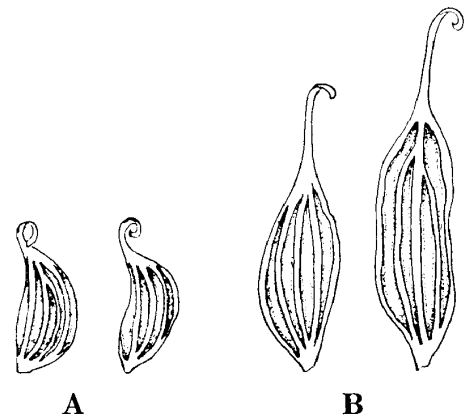


Fig. 8 Achenes of *Thalictrum calcicolum*
A : var. *calcicolum*
B : var. *longicarpum* × 6

connectives slightly mucronate at apex. Achenes numerous, 30-60, fusiform, shortly stalked, long beaked, slightly hispid, with 6-8 elevated ribs; stigma persistent, hooked. Chiang Mai: Doi Chiang Dao, T10035—type (KYO; isotype in BKF, SHIN), T. Smitinand 4750 (BKF), UNESCO 1027 & 1068 (BKF).—Among limestone rocks at ridges, at 1800-2175 m alt.

Distr. Endemic in North Thailand.

This species most closely resembles *T. dalzellii* Hook. from West India. However, the latter is characterized by glabrous leaflets, foliate inflorescences, fascicled flowers, filiform filaments and glabrous achenes less than 3 mm long. In respect to the character of the leaflets, the inflorescences and the filaments, the present species comes nearer to *T. scabrifolium* Franch. from Yunnan. However, that species differs from ours in having the pubescent stems, biternate leaves, and small achenes less than 3 mm long.

Two of the three species of *Thalictrum* treated here are endemic to the limestone ridges in North Thailand. (T. Shimizu)

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